OKLAHOMA SCHOOL of SCIENCE and MATHEMATICS

20th Annual OSSM Middle School Math:
An Awesome Contest—Round Two
7th-8th Grade Test

Spring 2022

Before you begin:

1. Please write your name on your answer sheet.
2. On your name tag you have been given a three-digit OSSM student ID number. On the answer sheet, in the lower right-hand corner, there is a place to fill in the three-digit student ID number (use the first three boxes, leaving the rest blank).
3. Fill in the appropriate bubbles for your OSSM student ID.

Directions:

1. Use the scratch paper provided to do your work.
2. Choose the appropriate answer, and then fill in the corresponding bubble ON THE ANSWER SHEET.
   DO NOT MAKE ANY STRAY MARKS ON YOUR ANSWER SHEET; it may cause the machine to misread your answer sheet and may disqualify your score.

This is a 40-question, 1-hour contest. All questions are multiple-choice. Figures are not to scale. Each question is worth one point. Your score will be the number of correct answers. There is no partial credit or penalty for wrong answers. Please continue working or reworking problems until time is called.

Do Not Open or Turn Over Until Instructed To Do So

Fill in your answers ON THE ANSWER SHEET by filling in the corresponding bubble.

DO NOT MAKE ANY STRAY MARKS ON YOUR ANSWER SHEET!

You may use this space for scratch paper.

WRITE YOUR ANSWERS ON THE ANSWER SHEET. DO NOT MAKE ANY STRAY MARKS ON YOUR ANSWER SHEET!

1. If $a = 17$ and $b = 31$, what is the value of $42a - 81b - 40(a - 2b)$?
   a. 1 b. 3 c. 5 d. 7 e. 9

2. What digit appears in the one-tenths place of $\frac{8}{5} - \sqrt{0.04}$?
   a. 4 b. 5 c. 6 d. 7 e. 8

3. $\frac{1}{2} \times \frac{4}{3} \times \frac{9}{4} \times \frac{16}{5} \times \frac{25}{6} =$
   a. 6 b. 15 c. 20 d. 36 e. 50

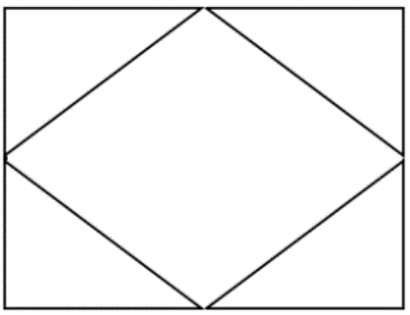
4. Which of the following absolute-value inequalities means the same thing as $0 < x < 1$?
   a. $|x| < 0.5$ b. $|x| < 1$ c. $|x - 0.5| < 0.5$ d. $|x - 0.5| < 1$ e. $|x - 1| < 0$

5. $50 \div \sqrt{50}$ is closest to which of these?
   a. 5 b. 6 c. 7 d. 8 e. 9

6. Which of the following is **not** equal to the other four?
   a. $\frac{n}{2}(2a - bc)$ b. $\frac{bcn}{2} - an$ c. $-\frac{n}{2}(cb - 2a)$ d. $an - \frac{1}{2}bcn$ e. $n\left(a - \frac{bc}{2}\right)$

7. Which of the following is **NOT** a factor of $100^2 - 1$?
   a. 9 b. 11 c. 101 d. 333 e. 1111

8. The midpoints of the sides of a 6x8 rectangle are joined to form a rhombus. What is the area of the rhombus?
   a. 20 b. 24 c. 25
   d. 27 e. 30



9. The midpoints of the sides of a 6x8 rectangle are joined to form a rhombus. What is the perimeter of the rhombus?
   a. 20 b. 24 c. 25
   d. 27 e. 30

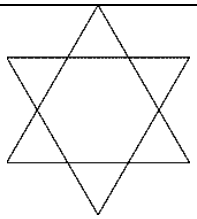
10. What is the sum of the two solutions for x in the following equation?
    $|x - 5| + |x - 7| = 22$
    a. 5 b. 10 c. 12 d. 17 e. 22

11. A double factorial $(n!!)$ is the multiplication of alternate positive integer starting with n and going down. For example, $5!! = 5 * 3 * 1$, and $4!! = 4 * 2$. Evaluate: $\frac{32!!}{30!!6!!}$

a. $\frac{8}{45}$ b. $\frac{2}{3}$ c. $\frac{3}{2}$ d. $\frac{248}{45}$ e. $\frac{124}{15}$

12. If $\left(\sqrt{37}\right)\left(\sqrt[3]{37}\right) = \sqrt[6]{37^n}$, what is the value of n?

a. 1 b. 2 c. 3 d. 4 e. 5



13. Two large overlapping equilateral triangles form a geometric figure consisting of a regular hexagon and six small equilateral triangles, as shown. If the area of one of the two large triangles is 30, what is the area of the entire figure?

a. 36 b. 39 c. 40
d. 42 e. 45

14. Three fourths of one half of a number is 33. What is the number?

a. $\frac{99}{8}$ b. $\frac{132}{5}$ c. $\frac{155}{4}$ d. 80 e. 88

15. What is the units digit of 22^{22}?

a. 0 b. 2 c. 4 d. 6 e. 8

16. In a dataset consisting of five positive whole numbers, the median is 3 and the mode is 4. What is the mean of this dataset?

a. 2.8 b. 3 c. 3.2 d. 3.5 e. 3.8

17. Two numbers, x and y, multiply to be 2022, and add up to 343. What is the sum of the digits of the two numbers?

a. 10 b. 16 c. 18 d. 19 e. 29

18. A triangle has smallest angle $35°$. What is the average of its other two angles?

a. $70°$ b. $72.5°$ c. $75°$ d. $77.5°$ e. $80°$

19. If $(3x + 5)^3$ is the volume of a cube, what is its surface area?

a. $4(3x + 5)^2$ b. $6(3x + 5)^2$ c. $(18x + 30)^2$ d. $(12x + 20)^2$ e. $(36x + 60)$

20. Kateri's average for the first 4 calculus tests was exactly 88%. What must she make on the 5th exam to earn a 90% average for all 5 tests.?

a. 90% b. 92% c. 94% d. 98% e. 102%

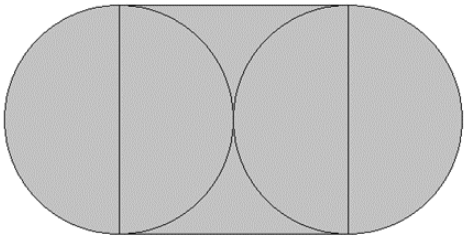
21. Solve the equation for x.

$$2x - \frac{3}{4}(4x + 5) = 5x - 2$$

a. $-\frac{23}{24}$ b. $-\frac{7}{16}$ c. $\frac{-7}{24}$ d. $\frac{23}{24}$ e. $\frac{23}{16}$

22. Assume $a = 10$ and $b = 7$, evaluate $a^8 b^{-4}(a^{-3}b^2)^3$

a. $\frac{1}{70}$ b. $\frac{49}{10}$ c. $\frac{100}{7}$ d. 7×10^8 e. $7^{10} \times 10^{17}$



23. The figure seen here consists of a square of side length 20 units. Two circles have been constructed using opposite sides of the square as diameters. Which of the following represents the area of the figure in square units?

a. $100(1 + 4\pi)$ b. $100(4 + \pi)$ c. $200(1 + 2\pi)$
d. $200(2 + \pi)$ e. $400(1 + \pi)$

24. How many square centimeters are there in 10 square meters?

a. 100 b. 1,000 c. 10,000 d. 100,000 e. 1,000,000

25. The hands of a common clock point in the exact same direction at noon and at midnight. How many other times during a day do the hands of a clock point in the same direction?

a. 19 b. 20 c. 21 d. 22 e. 23

26. A regular tetrahedron, also known as a triangular pyramid, is a solid object with 4 faces and 4 vertices. How many distinct line segments make up the edges of a tetrahedron?

a. 4 b. 5 c. 6 d. 7 e. 8

27. The sum of the first three terms of an arithmetic sequence is 20 and the sum of the next three numbers is 25. What is the first term in the sequence?

a. $\frac{5}{9}$ b. $\frac{10}{9}$ c. $\frac{45}{9}$ d. $\frac{55}{9}$ e. $\frac{65}{9}$

28. Simplify

$$\frac{1}{\sqrt{1}+\sqrt{2}} + \frac{1}{\sqrt{2}+\sqrt{3}} + \cdots + \frac{1}{\sqrt{49}+\sqrt{50}}$$

a. $1 - \sqrt{50}$ b. $\sqrt{50} - 1$ c. 7 d. $\sqrt{50}$ e. $5\sqrt{10} - 1$

29. Gopika is thinking of a positive whole number N. When you divide N by 27, the remainder is 14. When you divide N by 64, the remainder is 51. What is the remainder when you divide N by 12?

a. 2 b. 3 c. 5 d. 7 e. 11

30. Seventy-seven ghosts are loose in the mansion. If four ghostbusters try to catch them, and each ghostbuster has a container that can hold seventeen ghosts, how many ghosts will still be loose when all the containers are full?

a. 7 b. 8 c. 9 d. 10 e. 11

31. The radius of a cylinder is increased by 40%, but the height is cut in half. What is the percent change in the volume of the cylinder?
a. -3% b. -2% c. 0% d. 2% e. 3%

32. $64^{0.125} =$
a. $2^{0.5}$ b. $2^{0.75}$ c. 2 d. $2^{1.25}$ e. $2^{1.5}$

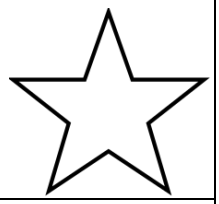
33. Two ants, Anusha and Zhizhe, race across a rectangular tabletop. They start at one end, crawl to the opposite end, then turn around and crawl back to their starting point, which also serves as the finish line. Anusha crawls at 0.05 m/s, while Zhizhe crawls at 0.04 m/s, so Anusha gives Zhizhe a 0.5-meter head start. If they both reach the finish line at the same time, how long did the race last?
a. 30 sec b. 45 sec c. 50 sec d. 60 sec e. 75 sec

34. How many different seven letter "words" can be formed by rearranging the letters in the word ALGEBRA?
a. 1260 b. 1520 c. 2048 d. 2520 e. 5040

35. Nancy brought five dozen (60) cookies to school. She gave 40% of the cookies to her teachers, 25% of remaining cookies to her best friend, and ate a third of what was left. What percent of the 5 dozen cookies remain?
a. 25% b. 30% c. 35% d. 40% e. 45%

36. A geometric shape is called "convex" if, for every pair of points that are inside the shape, the line segment joining those two points is also completely inside the shape. Which of the following shapes cold possibly be <u>non</u>-convex?
a. oval b. semicircle (with its diameter) c. scalene triangle
d. quadrilateral e. regular pentagon

37. A regular five-pointed star contains five acute angles, each with what angle measure?
a. $36°$ b. $37°$ c. $38°$
d. $39°$ e. $40°$



38. If a new arithmetic operation ֍ is defined by the formula $a֍b = 3a - b$, then which of these expressions is always equal to $(x֍x)֍(x֍x)$?
a. $(x + x) + (x + x)$ b. $(x - x) - (x - x)$ c. x^x
d. $(x \cdot x) \cdot (x \cdot x)$ e. $(x \div x) \div (x \div x)$

39. The probability that I go to the zoo next Saturday is 2/3. The probability that I go to the mall next Saturday is $2/3$. The probability that I go to **<u>at least one of</u>** the zoo and the mall next Saturday is $2/3$. What is the probability that I go to **<u>both</u>** the zoo and the mall next Saturday?
a. $\frac{8}{27}$ b. $\frac{1}{3}$ c. $\frac{4}{9}$ d. $\frac{1}{2}$ e. $\frac{2}{3}$

40. A hemisphere has a surface area (including its base) of $36\pi\ cm^2$. What is its volume?
a. $16\ cm^3$ b. $16\sqrt{3}\ cm^3$ c. $16\pi\sqrt{3}\ cm^3$ d. $32\pi\ cm^3$ e. $32\pi\sqrt{3}\ cm^3$

You may use this space for scratch paper,

The OSSM Difference

Challenge • Educate • Inspire • Serve • Lead • Succeed

www.ossm.edu